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HEAT DEVELOPABLE COLOR PHOTOSENSITIVE MATERIAL

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HEAT DEVELOPABLE COLOR PHOTOSENSITIVE MATERIAL

[Netsukenzo kara kanko zairyo]

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Applicant:	Konika Corp.

[There are no amendments to this patent.]

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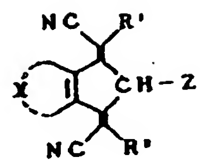
Claim

A type of heat developable color photosensitive material characterized by the following facts: the heat developable color photosensitive material has at least photosensitive silver halide, a reducing agent, and dye-supplying substances on a base material; at least one type of said dye-supplying substances is a compound that forms a dye with absorption maximum in the range of 400-700 nm, and it also contains a compound represented by following formula (1) and forming a dye with absorption maximum at wavelength longer than 725 nm.

Formula (1)

* [Numbers in right margin indicate pagination of original text.]



(where, R^1 and R^2 represent electron attractive groups with $\sigma p \geq 0.50$; X represents an atom group needed for forming a substituted or unsubstituted aromatic ring;
and Z represents hydrogen atom or a coupling type releasing group).

Detailed explanation of the invention

Industrial application field

This invention pertains to a type of heat developable color photosensitive material. More specifically, this invention pertains to a type of heat developable color photosensitive material that can read the recorded information with light at wavelength longer than 750 nm.

Background of the invention

In recent years, for various types of ID cards and other information recording materials, in addition to color image information, text information or bar code or other signal information is also recorded on the same recording material. For the recording material with said text information or signal information recorded on it, in order to make quick judgment of the [illegible] and to prevent misreading, mechanical reading is often performed using light at wavelength longer than 750 nm and emitted from a semiconductor laser or light-emitting diode.

On the other hand, the silver halide color photosensitive material is the best material for recording color pictures with respect to the image quality. Information recording materials using silver halide color photosensitive material have been under development. However, for the /2 conventional silver halide color photosensitive material, as processing is performed in a wet state, there are problems with respect to the ease of processing and processing speed.

Heat developable color photosensitive material, in particular, diffusion transfer type heat developable color photosensitive material, has been known as a material that has good image quality as a characteristic feature of the silver halide color photosensitive material and also is excellent with respect to simplicity and high speed of processing.

The diffusion transfer type heat developable color photosensitive material and its image forming method are described in, e.g., the following patents: Japanese Kokai Patent Application Nos. Sho 59[1984]-12431, Sho 59[1984]-159159, Sho 59[1984]-181345, Sho 59[1984]-229556, Sho 60[1985]-2950, Sho 61[1986]-52643, Sho 61[1986]-61158, Sho 61[1986]-61157, Sho 59[1984]-180550, Sho 61[1986]-132952, Sho 61[1986]-139842, US Patent Nos. 4,595,652, 4,590,154, 4,584,627, etc.

However, for the aforementioned diffusion transfer type heat developable color photosensitive material, usually, dye-supplying substances that can form or release dyes of three colors, that is, yellow, magenta, and cyan, are used. Consequently, it is hard to read the recorded information with light at wavelength longer than 750 nm.

In order to improvement on this problem, the present inventors have proposed a type of compound for forming dye having maximum absorption at a wavelength longer than 725 nm.

By containing such a compound, the heat developable color photosensitive material can have a constitution that enables said read operation.

However, for the compound proposed by the present inventors, although it can meet the demand that the absorption maximum be at wavelength longer than 725 nm, it is still at a relatively short wavelength, and it is hard to prepare. This is undesired.

Purpose of the invention

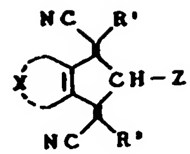
The purpose of this invention is to solve the aforementioned problem.

That is, the purpose of this invention is to provide a type of heat developable color photosensitive material characterized by the fact that it allows easy reading of the recorded information with light at wavelength longer than 750 nm by using dye-supplying substances which can form dyes with good coloring property, good transfer property, high thermal stability, and preferable absorption in the IR region, and which are free of the aforementioned problems in preparation.

Constitution of the invention

In order to solve the aforementioned problems, the present inventors have performed extensive research. As a result of this research work, it was found that the aforementioned purpose of this invention can be realized by a type of heat developable color photosensitive material characterized by the following facts: the heat developable color photosensitive material has at least photosensitive silver halide, a reducing agent, and dye-supplying substances on a base material; at least one type of said dye-supplying substances is a compound that forms a dye with absorption maximum in the range of 400-700 nm, and it also contains a compound represented by following formula (1) and forming a dye with absorption maximum at wavelength longer than 725 nm.

Formula (1)



Where, R^1 and R^2 represent electron attractive groups with $\sigma p \geq 0.50$; X represents an atom group needed for forming an optionally substituted aromatic ring.

Z represents a hydrogen atom or a coupling type releasing group.

In the following, this invention will be explained in detail.

According to this invention, the dye formed from the compound represented by formula (1) "has an absòrption maximum at wavelength longer than 725 nm" meaning that when the compound is heat-developed to form a dye, the dye has an absorption maximum (λmax) meeting said condition, and, in the case of transfer system, the reflection density or transmission density of the dye image transferred on a transfer member has said absorption maximum.

First of all, explanation will be made ot the compound represented by formula (1), that is, the compound that can form a dye having absorption maximum longer than 725 nm (it may be referred to as "the IR dye of this invention" as needed) (in the following, this type of compound may be referred to as the IR coupler of formula (1)).

For the IR coupler represented by formula (1), the molecular weight (the molecular weight of the portion excluding Z) is preferably 700 or smaller, or more preferably 500 or /3
smaller. When the molecular weight is within this range, the generated IR dye has especially good transfer property.

Also, in order to improve the immobility in the photosensitive layer or to improve the solubility with respect to the coupler solvent, the IR coupler represented by formula (1) preferably has a ballast group (preferably C-8 or higher organic group or polymer residual group), and the ballast group is preferably substituted with Z.

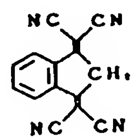
R^1 and R^2 represent electron attractive groups with $\sigma p \geq 0.50$. Examples include sulfonyl group, sulfonic ester, dicyanovinyl group, carboxyvinyl group, tetrazolyl group, cyano group, phosphoric ester, sulfamoyl group, perfluoroalkyl group, ω hydro perfluoroalkyl group, nitro group, etc. Among them, the preferable groups include cyano group, fluoro alkyl group, and alkyl sulfo group. When a dye substituted with an electron attractive group with σp smaller than 0.5 is formed, the absorption maximum is at a shorter wavelength. This is undesired.

X represents an atom group needed for forming substituted or unsubstituted aromatic ring, or preferably substituted or unsubstituted benzene ring or aromatic heterocyclic ring. The substituent for the aromatic ring formed by X may be selected as desired. More specifically, it may be selected from alkyl group, aryl group, nitro group, halogen atom, aryloxy group, etc. at will corresponding to the absorption wavelength and solubility.

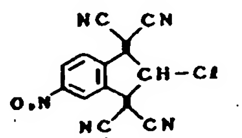
Z represents hydrogen or coupling releasing group. In particular, a coupling releasing group is preferred for it. Examples of the preferable coupling releasing groups include halogen atom (such as chlorine, bromine, iodine), sulfo group, alkoxy group, aryloxy group, thiocyano group, acyloxy group, arylthio group, nitrogen-containing heterocyclic residual group, etc.

The following are specific examples of the IR couplers represented by formula (1). However, the compounds that may be used in this invention are not limited to them.

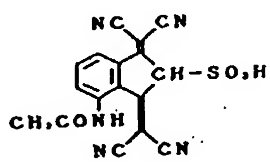
IR-1



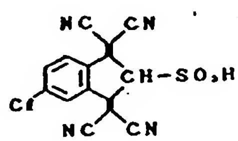
IR-2



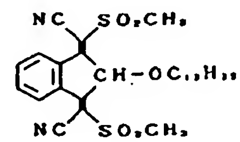
IR-3



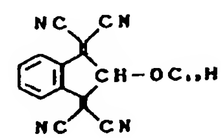
IR-4



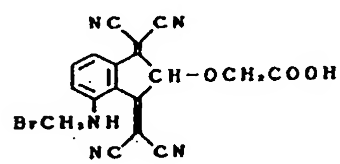
IR-5



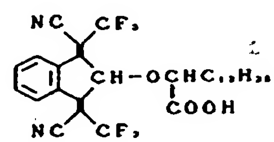
IR-6



IR-7

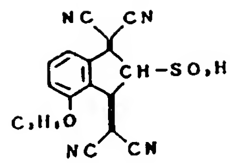


IR-8

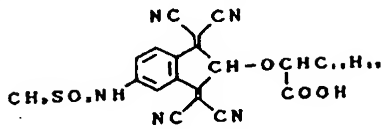


/4

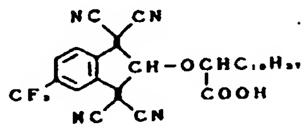
IR-9



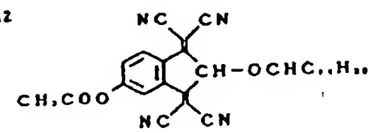
IR-10



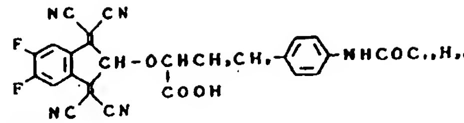
IR-11



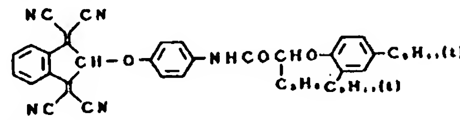
IR-12



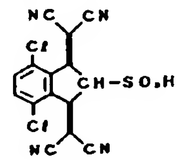
IR-13



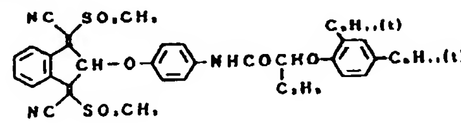
IR-14



IR-15

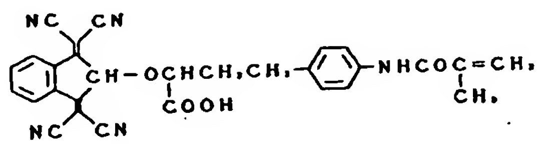


IR-16



IR-17

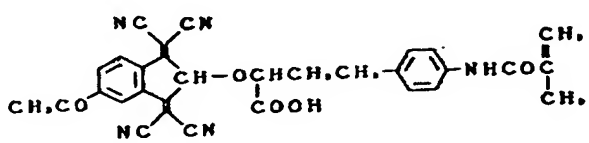
Copolymer of



and butyl acrylate (composition ratio by weight: 5:5)

IR-18

Copolymer of



and BA (composition ratio by weight of 6:4)

In the following, typical examples of preparation of IR couplers represented by formula (1) are presented.

Preparation Example 1 (Preparation of IR-6)

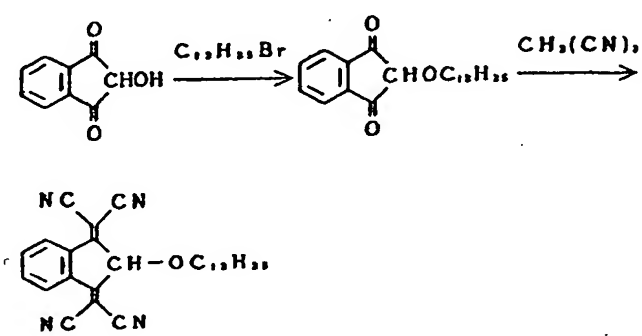
5.67 g of 2-hydroxy-1,3-indane dione, 8.00 g of n-dodecyl bromide, and 4.35 g of potassium carbonate were dissolved in 70 mL of dry acetone, followed by reflux for 2 h. After cooling, the reaction solution was poured in 350 mL of diluted hydrochloric acid, and the deposited crystal was filtered and dried, forming 9.72 g of 2-dodecanoxy-1,3-indane dione.

9.72 g of said 2-dodecanoxy-1,3-indane dione, 6.93 g of malononitrile were dissolved in 50 mL of ethanol. After agitation at room temperature for 15 min, 7.14 g of sodium acetate (trihydrate) were added.

After the mixture was heated with reflux for 5 h, it was cooled, and the reaction solution was filtered to remove monomers. Then, the filtrate was diluted with 120 mL of water, followed by adjustment with hydrochloric acid to pH 1-2.

The deposited crystal was washed with water and dried, forming 9.99 g of white crystal.

The following is the main reaction route.



Preparation Example 2 (Preparation of IR-14)

29.22 g of 1,3-indane dione and 32.11 g of N-chloro succinic acid imide were suspended in 200 mL of chloroform. After agitation at room temperature for 30 min, the solution was set for 2 days. Then, chloroform was distilled off, followed by separation by means of column chromatography, forming 12.48 g of 2-chloro-1,3-indane dione.

12.48 g of said 2-chloro-1,3-indane dione and 13.56 g of p-nitrophenol sodium salt were suspended in 150 mL of acetone, followed by reflux for 2 h.

After acetone was distilled off, extraction was performed with ethyl acetate, followed by water washing and refinement by means of column chromatography, forming 6.05 g of 2-(p-nitrophenoxy)-1,3-indane dione.

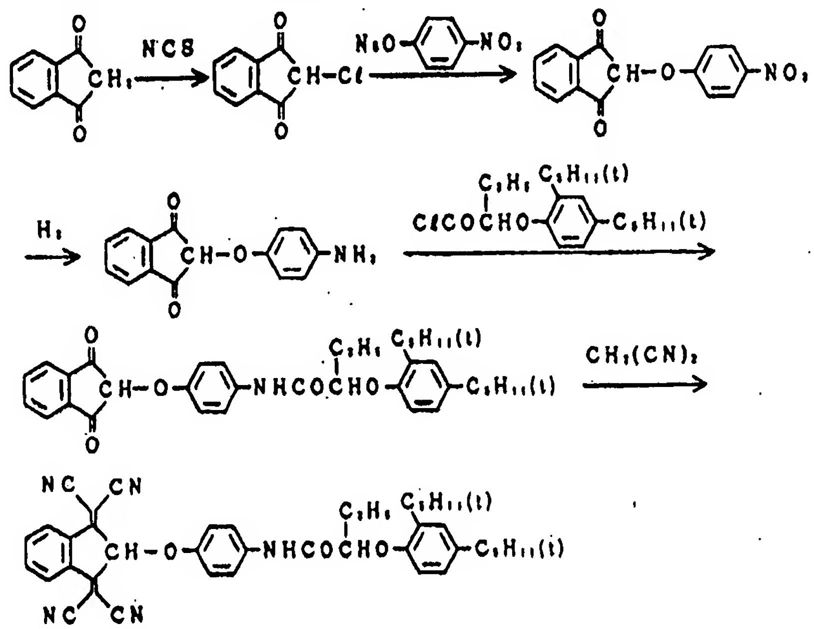
It was dissolved in 100 mL of ethanol. With palladium carbon used as a catalyst, 5.22 g of 2-(p-aminophenoxy)-1,3-indane dione were obtained.

The entire amount was dissolved in 50 mL of acetonitrile. Then, 2.00 g of pyridine were added, and 7.68 g of 2-(2,4-ditertiary amylphenoxy)butanoyl chloride were added dropwise.

After agitation for 1 h, acetonitrile was distilled off under a reduced pressure, followed by extraction with ethyl acetate and water washing. After ethyl acetate was distilled off under a reduced pressure, refinement was performed by means of column chromatography, forming 6.7 g of 2-(4-(2-(2,4-di-tert-amylphenoxy)butane amido)phenoxy -1,3-indane dione.

5.6 g of said compound and 2.0 g of malononitrile were dissolved in 30 mL of ethanol. After agitation at room temperature for 15 min, 2.1 g of sodium acetate (trihydrate) were added, and the mixture was agitated for 30 min. Then, the reaction solution was poured in diluted hydrochloric acid, and the deposited crystal was washed with water and filtered, forming 1.95 g of compound IR-14, that is, 2-(4-(1-(2,5-di-t-amylphenoxy)propionylamino)phenoxy)-5-acetyl-1,3-bisdicyanodivinyl indane.

The main reaction route is as follows.



/6

Identification was performed by means of FD-Mass.

$C_{41}H_{41}N_5O_3$

Calculated value of molecular weight: 555.7

Measured value of molecular weight: 555

The amount of the IR coupler represented by formula (1) added in the heat developable color photosensitive material of this invention depends on the characteristics of the IR coupler in use and the characteristics of the photosensitive material. The optimum amount should ensure

that for the IR dye density of the obtained image, the reflection density measured with light at wavelength of 800 nm is 0.3 or higher, or preferably 0.5 or higher.

More specifically, the amount of the IR coupler represented by formula (1) with respect to 1 m^2 of the photosensitive material should be in the range of 0.005-50 g, or preferably in the range of 0.1-10 g. Also, the IR couplers represented by formula (1) may be used either in a single type or as a mixture of two types or more.

Usually, the IR coupler represented by formula (1) is added in the layer containing photosensitive silver halide, or in its adjacent layers. More preferably, it is added in the cyan coupling layer or the layer identical to the cyan dye-supplying substance. Any method may be adopted for adding it. For example, the same method as that for adding dye-supplying substance to be explained later may be adopted to add it alone or together with the dye-supplying substance.

In the following, explanation will be made on the dye-supplying substances contained in the heat developable color photosensitive material of this invention. According to this invention, one or several types of the dye-supplying substances are contained. At least one of them is a compound that forms a dye with absorption maximum at wavelength in the range of 400-700 nm. This substance can act as a coloring coupler.

The dye-supplying substances may be various dye-supplying substances contained in the same layer and/or different layers as that containing the IR coupler represented by formula (1). It is also possible to make use of the following substances as the dye-supplying substances: the couplers for forming nondiffusive dyes described in Japanese Kokai Patent Application No. Sho 62[1987]-44737, Japanese Patent Application Nos. Sho 60[1985]-271117 and Sho 61[1986]-11563, the leuco dye for forming nondiffusive dye described in US Patent No. 475,441, and the azo dye used in the heat-developing dye bleaching method described in US Patent No. 4,235,957. More preferably, one may make use of a diffusive dye-supplying substance that forms or releases a diffusive dye together with the IR coupler represented by formula (1). In particular, it is preferred that a compound that forms diffusive dye in a coupling reaction be used.

In the following, explanation will be made on the diffusive dye-supplying substance that can be used together with the IR coupler represented by formula (1). The diffusive dye-supplying substance should be able to form or release diffusive dye corresponding to the reduction reaction of photosensitive silver halide and/or the organic silver salt used as needed and as a function of said reduction reaction. The diffusive dyes can be classified corresponding to the reaction type to negative type dye-supplying substances and positive type dye-supplying substances.

Examples of the negative type dye-supplying substances include the reductive dye releasing compounds described in the following patents: US Patent Nos. 4,463,079, 4,439,513,

Japanese Kokai Patent Application Nos. Sho 59[1984]-60434, Sho 59[1984]-65839, Sho 59[1984]-71046, Sho 59[1984]-87450, Sho 59[1984]-86730, Sho 59[1984]-123837, Sho 59[1984]-124329, Sho 59[1984]-165054, Sho 59[1984]-164055, etc.

Other examples of the negative type dye-supplying substances include the coupling dye forming compounds described in the following patents: US Patent No. 4,474,867, Japanese Kokai Patent Application Nos. Sho 59[1984]-12431, Sho 59[1984]-48765, Sho 59[1984]-174834, Sho 59[1984]-776642, Sho 59[1984]-159159, Sho 59[1984]-231040, etc.

Other examples of the negative type dye-supplying substances are the coupling dye forming compounds represented by following formula (a).

Formula (a)

$$Cp-(J)-(B)$$

where, Cp represents an organic group (coupling residual group) that can react with the oxide of a reducing agent (coupling reaction) to form a diffusive dye; J represents a divalent bonding group that bonds with the active site that reacts with the oxide body of the reducing agent; and B represents a ballast group. Here, the ballast group acts to ensure that there is substantially no diffusion of the dye-supplying substance during the heat development treatment. It may be a group that displays the function depending on the properties of the molecules (sulfo group, etc.), or a group that displays the function depending on the size of the molecules (group with a large carbon number, etc.). For the coupler residual group represented by Cp, in order to improve the /7 diffusion property of the dye formed, the molecular weight should be 700 or smaller, or preferably 500 or smaller.

The ballast group represented by B preferably has 8 or more carbon atoms, or more preferably has 12 or more carbon atoms, and the group as a polymer chain is even more preferred.

As the coupling dye forming compound having the polymer chain group, it is preferred that a polymer chain having repeated units derived from the monomer represented by formula (b) be contained as said group.

Formula (b)

$$Cp-(J)-(Y)_l-(Z)-(L)$$

where, Cp and J have the same meanings as those defined in formula (a); Y represents alkylene group, arylene group, or aralkylene group; l represents 0 or 1; Z represents a divalent organic group; and L represents a group having an ethylenic unsaturated group or ethylenic unsaturated [sic] group.

Preferable examples of the coupling dye forming compounds represented by formulas (a) and (b) include those described in Japanese Kokai Patent Application Nos. Sho 59[1984]-124339, Sho 59[1984]-181345, Sho 60[1985]-2950, Sho 61[1986]-57943, and Sho

61[1986]-59336, US Patent Nos. 4,631,251, 4,650,748, 4,656,124, etc., and preferably the polymer type dye-supplying substances described in US Patent Nos. 4,656,124, 4,631,251, and 4,650,748.

Examples of the positive type dye-supplying substances include the compounds described in Japanese Kokai Patent Application Nos. Sho 59[1984]-55430, Sho 59[1984]-165054, Sho 59[1984]-154445, Sho 59[1984]-766954, Sho 59[1984]-116655, Sho 59[1984]-124327, Sho 59[1984]-152440, etc.

These dye-supplying substances may be used either alone or as a mixture of several types. There is no special limitation on the amount of the dye-supplying substances. The amount may be determined appropriately corresponding to the type of the dye-supplying substance, whether the dye-supplying substance(s) is used alone or as a mixture of two or more types, and whether the photosensitive material of this invention has a single photographic structural layer or two or more photosensitive layers. For example, the amount with respect to 1 m^2 may be in the range of 0.005-50 g, or preferably in the range of 0.1-10 g.

Any method may be adopted in containing the dye-supplying substance of this invention in the photographic structural layer of the heat developable color photosensitive material. For example, in one method, it is dissolved in a low-boiling point solvent (methanol, ethanol, ethyl acetate, etc.) and/or a high-boiling point solvent (dibutyl phthalate, dioctyl phthalate, tricresyl phosphate, etc.), followed by emulsification and dispersion. In another method, it is dissolved in alkaline aqueous solution (such as 10% aqueous solution of sodium hydroxide), followed by neutralization with an acid (such as citric acid or nitric acid). In another method, the solid is dispersed in an aqueous solution of an appropriate type of polymer (such as gelatin, polyvinyl butyral, polyvinyl pyrrolidone, etc.) before use.

In the following, explanation will be made on the photosensitive silver halide used in this invention. Any type of silver halide may be used. Examples include silver chloride, silver bromide, silver iodide, silver chlorobromide, silver chloroiodide, silver iodobromide, etc. The photosensitive silver halide may be prepared using any method that is conventionally adopted in the photographic technical field.

In addition, the emulsion may contain grains having multi-layer structure having different halogen compositions for the surface layer and internal layer. For example, one may make use of silver halide emulsion having core/shell type silver halide grains having halogen composition varying stepwise, or having silver halide grains having halogen composition varying continuously.

As far as the shape of the photosensitive silver halide grains is concerned, the grains may have clearly defined crystalline shapes, such as cubic, spherical, octahedral, undecahedral, tetradecahedral, etc. Also, the grains may not have said clearly defined crystalline shape. The

silver halide grains of this type are described in Japanese Kokai Patent Application No. Sho 60[1985]-215948.

Also, one may make use of a silver halide emulsion containing flake-shape silver halide grains which have two parallel crystalline planes, with area of said parallel crystalline planes larger than the area of other single crystals of the grains and with aspect ratio (ratio of the diameter to thickness of the grains) of 5:1 or larger, as described in Japanese Kokai Patent Application Nos. Sho 58[1983]-111933, Sho 58[1983]-111934, Sho 58[1983]-108526, Research Disclosure No. 22534, etc. /8

In addition, in this invention, it is possible to make use of a silver halide emulsion containing internal latent image type silver halide grains without overdeveloping of the surface beforehand. For example, the internal latent image type silver halide without pre-overdeveloping of the surface is described in US Patent Nos. 2,592,250, 3,206,313, 3,317,322, 3,511,622, 3,447,927, 3,761,266, 3,703,584, 3,736,140, etc. As described in the above listed patents, the internal latent image type silver halide grains without pre-overdevelopment of the surface are silver halide grains for which the sensitivity on the surface of the grains is higher than that of the interior of the grains. Also, it is possible to make use of the following types of silver halide grains: silver halide grains containing polyvalent metal ions described in US Patent Nos. 3,271,157, 3,447,927, 3,531,291, etc.; silver halide emulsion chemically sensitized for the surface of the silver halide grains containing a doping agent described in US Patent No. 3,761,276; silver halide emulsion made of grains having laminated structure described in Japanese Kokai Patent Application Nos. Sho 50[1975]-8524 and Sho 50[1975]-38525, etc.; the silver halide emulsion described in Japanese Kokai Patent Application Nos. Sho 52[1977]-156614, Sho 55[1980]-127549, etc.

The silver halide grains in said photosensitive emulsions may be rough grains or fine grains. However, the grain diameter is preferably in the range of about 0.005-1.5 μm, or more preferably in the range of about 0.01-0.5 μm.

According to this invention, as another method for preparing the photosensitive silver halide, one may have the photosensitive silver salt forming component coexist with the organic silver salt to be explained later, so that a photosensitive silver halide is formed in a portion of the organic silver salt.

Said photosensitive silver halide and photosensitive silver salt forming component may be used in combination in various forms. The amount used in each layer with respect to 1 m^2 of the base material is preferably in the range of 0.001-50 g, or more preferably in the range of 0.1-10 g.

The photosensitive silver halide emulsion may be chemically sensitized using any method adopted in the field of photographic technology.

Also, the photosensitive silver halide emulsion used in this case may be spectrally sensitized with conventional spectral sensitizing dyes to have higher sensitivity in blue, green, red, and near-IR regions.

Typical examples of the spectral sensitizing dyes that may be used include cyanine, merocyanine, complex (that is, 3-nuclei or 4-nuclei) cyanine, holopolar-cyanine, styryl, hemi-cyanine, oxonol, etc.

The amount of the sensitizing dyes added with respect to 1 mol of the photosensitive silver halide or silver halide forming component should be in the range of 1×10^{-4} mol ~ 1 mol, or more preferably in the range of $1 \times 10^{-4} \sim 1 \times 10^{-1}$ mol.

The sensitizing dyes may be added in any step of the manufacturing process of silver halide emulsion. That is, they may be added during formation of silver halide grains, during removal of soluble salts, before the start of chemical sensitization, during chemical sensitization, or after end of chemical sensitization.

The heat developable color photosensitive material of this invention may contain various organic silver salts for increasing sensitivity or for improving the development property as needed.

Examples of the organic silver salts that can be used in the heat developable color photosensitive material of this invention include silver salts of long-chain aliphatic carboxylic acids and silver salts of carboxylic acids having heterocyclic groups, such as silver behenate, silver α-(γ-phenyl tetrazole thio)acetate, etc., described in Japanese Kokai Patent Application Nos. Sho 53[1978]-4921, Sho 49[1974]-52626, Sho 52[1977]-141222, Sho 53[1978]-36224, Sho 53[1978]-37626, Sho 53[1978]-37610, etc. as well as US Patent Nos. 3,330,633, 3,794,496, 4,105,451, etc.; and the silver salts of imino groups described in Japanese Kokoku Patent Nos. Sho 44[1969]-26582, Sho 45[1970]-12700, Sho 45[1970]-18416, Sho 45[1970]-22185, Japanese Kokai Patent Application Nos. Sho 52[1977]-137321, Sho 58[1983]-118638, Sho 58[1983]-118639, and US Patent No. 4,123,274.

Among the above-listed organic silver salts, the silver salts of imino groups are preferred. In particular, the following types are more preferred: 5-methyl benzotriazole and its derivative, sulfo benzotriazole and its derivative, N-alkyl sulfamoyl benzotriazole and its derivative.

The organic silver salts used in this invention may be used either alone or as a mixture of /9
several types. Also, a silver salt may be prepared in an appropriate binder, and without separation, the mixture is used as is. Also, the silver salt in separated form may be dispersed in a binder using an appropriate means for use. Examples of the means for dispersing include ball mill, sand mill, colloid mill, vibration mill, etc. However, means for dispersing are not limited to these examples.

The amount of the organic silver salt used with respect to 1 mol of the photosensitive silver halide is preferably in the range of 0.01-500 mol, or more preferably in the range of 0.1-100 mol, or most preferably in the range of 0.3-30 mol.

The reducing agent used in the heat developable color photosensitive material of this invention (in the specification of this patent application, reducing agents also include reducing agent precursors) may be of the type commonly used in the field of the heat developable color photosensitive material.

Examples of the reducing agents that can be used in this invention are described in US Patent Nos. 3,531,286, 3,761,270, 3,764,328, RD (Research Disclosure) No. 12146, No. 15706, No. 15127, Japanese Kokai Patent Application No. Sho 56[1981]-27132, US Patent Nos. 3,342,599, 3,719,492, Japanese Kokai Patent Application Nos. Sho 53[1978]-135628, Sho 57[1982]-79035, etc. They include p-phenylene diamine-based and p-aminophenol-based developing agents, phosphoamidophenol based and sulfonamide aniline-based developing agents, hydrazone-based coupling developing agents, their precursors, as well as phenols, sulfonamide phenols, polyhydroxybenzenes, naphthols, hydroxy binapthyls, methylene bisnaphthols, methylene bisphenols, ascorbic acid, 3-pyrazolidones, pyrazolones, etc.

Also, the dye-supplying substance may act as a reducing agent at the same time.

Preferable examples of reducing agents include N-(p-N,N-dialkyl)phenyl sulfamates described in Japanese Kokai Patent Application Nos. Sho 56[1981]-146133 and Sho 62[1987]-727141.

One may make use of two or more types of the reducing agents at the same time.

The amount of the reducing agent used in the heat developable color photosensitive material of this invention depends on the type of the photosensitive silver halide in use, the type of organic silver salt, and the types of other additives, and cannot just be determined once for all. Usually, with respect to 1 mol of the photosensitive silver halide, the amount of the reducing agent should be in the range of 0.01-1500 mol, or preferably in the range of 0.1-200 mol.

An appropriate type of binder may be used in preparing the heat developable photosensitive material of this invention. Examples of the binders that may be used include polyvinyl butyral, polyvinyl acetate, ethyl cellulose, polymethyl methacrylate, cellulose acetate butyrate, polyvinyl alcohol, polyvinyl pyrrolidone, gelatin, phthalated gelatin, and other gelain derivatives, cellulose derivative, protein, Arabic gum, and other synthetic and natural polymer substances. They may be used either alone or as a mixture of several types. In addition, it is preferred that gelatin or its derivative be used together with polyvinyl pyrrolidone, polyvinyl alcohol, and other hydrophilic polymers. More preferably, one may make use of a binder made of a combination of the gelatin described in Japanese Kokai Patent Application No. Sho 59[1984]-229556 and polyvinyl pyrrolidone.

The preferable amount of the binder with respect to 1 m^2 of the base material should be in the range of 0.05-50 g, or preferably in the range of 0.2-20 g.

The amount of the binder with respect to 7 g of the dye-supplying substance is preferably in the range of 0.1-10 g, or more preferably in the range of 0.2-5 g.

The heat developable color photosensitive material of this invention is prepared by forming photographic structural layers on a base material. Examples of the base materials that may be used include polyethylene film, cellulose acetate film, polyethylene terephthalate film, polyvinyl chloride film, and other synthetic plastic films, photographic feed paper, printing paper, baryta paper, resin coated paper, and other paper base materials, as well as base materials prepared by coating and curing an electron beam curable resin composition on said base materials. /10

When the heat developable color photosensitive material of this invention and an image receiving material (when the photosensitive material is of a transfer type) are used, it is preferred that various types of thermal solvents be added in the heat developable color photosensitive material and/or image receiving material. The thermal solvent is in liquid form during heat development, and it is a compound that accelerates heat development and/or heat transfer. Examples of these compounds include polar organic compounds described in US Patent Nos. 3,347, 675 and 3,667,959, RD (Research Disclosure) No. 17643 (XII), Japanese Kokai Patent Application Nos. Sho 59[1984]-229556, Sho 59[1984]-68730, Sho 59[1984]-84236, Sho 60[1985]-5191251, Sho 60[1985]-232547, Sho 60[1985]-14241, Sho 61[1986]-52643, Sho 62[1987]-78554, Sho 62[1987]-42153, Sho 62[1987]-44737, US Patents Nos. 3,438,776, 3,666,477, and 3,667,959, Japanese Kokai Patent Application Nos. Sho 51[1976]-19525, Sho 63[1978]-24829, Sho 53[1978]-60223, Sho 58[1983]-118640, Sho 58[1983]-198038, etc. The types that are especially preferred for use in this invention include urea derivatives (such as dimethylurea, diethylurea, phenylurea, etc.), amide derivatives (such as acetamide, benzamide, p-toluamide, etc.), sulfonamide derivatives (such as benzene sulfonamide, α-toluene sulfonamide, etc.), polyhydric alcohols (such as 1,6-hexane diol, 1,2-cyclohexane diol, pentaerythritol, etc.), polyethylene glycols, etc.

Among the aforementioned thermal solvents, the water-insoluble solid thermal solvents are especially preferred.

Specific examples of said water-soluble [sic; water-insoluble] thermal solvents are described in Sho 62[1987]-136645, Sho 62[1987]-139549, Sho 63[1988]-53548, Japanese Patent Application No. Sho 63[1988]-39950, and Sho 63[1988]-54113.

The layers where the thermal solvent can be added include photosensitive silver halide emulsion layer, intermediate layer, protective layer, image receiving layer of the image receiving material, etc. The thermal solvent is added in these layers to realize the corresponding effects.

The preferable amount of the thermal solvent to be added with respect to the conventional binder amount should be in the range of 10-500 wt%, or preferably in the range of 30-200 wt%.

The organic silver salt and thermal solvent may be dispersed in the same dispersion. The binder, dispersion [illegible], and dispersing device are of the same types as those used in preparing their dispersions, respectively.

In addition to the aforementioned components, various additives may also be contained in the heat developable color photosensitive material of this invention. Examples of the additives include development accelerating agent, fog inhibitor, base precursor, etc.

Examples of the development accelerating agents that may be used include the compounds described in Japanese Kokai Patent Application Nos. Sho 59[1984]-177550, Sho 59[1984]-111636, Sho 59[1984]-724333; the development accelerating agent releasing compounds described in Japanese Kokai Patent Application No. Sho 61[1986]-159642 and Japanese Patent Application No. 62[1987]-203908; and the metal ions having electronegativity of 4 or larger described in Japanese Patent Application No. 63[1988]-104645.

Examples of the fog inhibitors that may be used include the higher fatty acids described in US Patent No. 3,645,739, the mercuric salts described in Japanese Kokai Patent Application No. Sho 47[1972]-17713, the N-halogen compounds described in Japanese Kokai Patent Application No. Sho 51[1976]-47419, the mercapto compound releasing compounds described in US Patent No. 3,700,457 and Japanese Kokai Patent Application No. Sho 51[1976]-50725, the aryl sulfonic acid described in Japanese Kokai Patent Application No. Sho 49[1974]-125016, the lithium carboxylate described in Japanese Kokai Patent Application No. Sho 51[1976]-47419, the oxidants described in British Patent No. 1,455,271 and Japanese Kokai Patent Application No. Sho 50[1975]-101019, the sulfinic acids and thiosulfonic acids described in Japanese Kokai Patent Application No. Sho 53[1978]-19825, the 2-thiourasyls described in Japanese Kokai Patent Application No. Sho 51[1976]-3223, the simple-form sulfur described in Japanese Kokai Patent Application No. Sho 51[1976]-26019, the disulfide and polysulfide compounds described in Japanese Kokai Patent Application Nos. Sho 51[1976]-42525, Sho 51[1976]-81124, and Sho 55[1980]-93149, the rosin and diterpenes described in Japanese Kokai Patent Application No. Sho 51[1976]-57435, the polymeric acids having free carboxyl groups and sulfonate groups described in Japanese Kokai Patent Application No. Sho 51[1976]-104338, the thiazolinethione described in US Patent No. 4,138,265, the 1,2,4-triazole or 5-mercapto-1,2,4-triazole described in Japanese Kokai Patent Application No. Sho 54[1979]-51821 and US Patent No. 4,137,079, the thiosulfinic esters described in Japanese Kokai Patent Application No. Sho 55[1980]-140883, the 1,2,3,4-thiatriazoles described in Japanese Kokai Patent Application No. Sho 55[1980]-142331, the dihalogen compounds or trihalogen compounds described in Japanese Kokai Patent Application Nos. Sho 59[1984]-45641, Sho 59[1984]-57233, Sho 59[1984]-57234, the thiol /11

compounds described in Japanese Kokai Patent Application No. Sho 59[1984]-111636, hydroquinone derivatives described in Japanese Kokai Patent Application No. Sho 60[1985]-198546, or the hydroquinone derivatives and benzotriazole derivatives used together as described in Japanese Kokai Patent Application No. Sho 60[1985]-227255, etc.

Examples of the fog inhibitors that can preferably be used include the inhibitors having hydrophilic groups described in Japanese Kokai Patent Application No. Sho 62[1987]-78554, the polymer inhibitors described in Japanese Kokai Patent Application No. Sho 62[1987]-121452, and the inhibitors having ballast groups described in Japanese Kokai Patent Application No. Sho 62[1987]-123456.

Also, the non-coloring coupler described in Japanese Patent Application No. Sho 62[1987]-320599 can preferably be used.

Examples of the base precursors include compounds that can release basic substances by decarboxylation in heating (such as guanidinium trichloroacetate), compounds that can release amines by decomposition in intra-molecular nucleophilic substitution reaction or other reaction, such as the base releasing agents described in the following patents: Japanese Kokai Patent Application Nos. Sho 56[1981]-130745, Sho 56[1981]-132332, British Patent No. 2,079,480, US Patent No. 4,060,420, Japanese Kokai Patent Application Nos. Sho 59[1984]-157637, Sho 59[1984]-166943, Sho 59[1984]-180537, Sho 59[1984]-174830, Sho 59[1984]-195237, Sho 62[1987]-108249, Sho 62[1987]-174745, etc.

Examples of the various additives that can be used in the heat developable color photosensitive material as needed include halation-inhibiting dyes, fluorescent whitening agents, film hardeners, static inhibitors, plasticizers, spreading agents, matting agents, surfactants, fading inhibitors, etc. Specific examples of these additives are described in RD (Research Disclosure) Vol. 170, June 1970, No. 17029, Japanese Kokai Patent Application No. Sho 62[1987]-135825, etc.

The additives of these types are not only added in the photosensitive layers, but also in intermediate layer, protective layer, backing layer, and other non-photosensitive layers.

The heat developable color photosensitive material of this invention contains (a) photosensitive silver halide, (b) reducing agent, (c) dye-supplying substance, and (d) compound represented by formula (1), as well as (e) binder as needed. Also, it is preferred that (f) organic silver be contained as needed. Basically, they may be contained in a single heat developable photosensitive layer. However, it is not a necessity to contain them in a single photographic structural layer. For example, there may be two heat developable photosensitive layers, with said components (1), (b), (d), (e) and (f) contained in one of these layers, and with dye-supplying substance (c) contained in the other layer. That is, they may be contained in two or more structural layers in a state in which they can react with each other.

Also, the heat developable photosensitive layer may be divided into two or more layers, that is, a low-sensitivity layer and a high-sensitivity layer, or a low-density layer and a high-density layer.

The heat developable color photosensitive material of this invention may have 1, 2 or more heat developable photosensitive layers. For a full-color photosensitive material, usually it has three heat developable photosensitive layers having different color sensitivities. In the various photosensitive layers, in heat development, dyes having different colors are formed or released.

Usually, yellow dye is contained in the blue photosensitive layer; magenta dye is contained in the green photosensitive layer; and cyan dye is contained in the red photosensitive layer. However, the constitution is not limited to this. Also, it is also possible to incorporate a near-IR photosensitive layer.

The constitution of the various layers may be selected corresponding to the specific purpose. For example, it may have the following constitutions: a constitution in which a red photosensitive layer, a green photosensitive layer, and a blue photosensitive layer are sequentially formed on a base material; a constitution in which a blue photosensitive layer, a green photosensitive layer, and a red photosensitive layer are sequentially formed on a base material; or a constitution in which a green photosensitive layer, a red photosensitive layer, and a blue photosensitive layer are sequentially formed on a base material.

For the heat developable color photosensitive material of this invention, in addition to said heat developable photosensitive layers, there may be other non-photosensitive layers formed as desired, such as primer layer, intermediate layer, protective layer, filter layer, backing layer, separating layer, etc. Coating of said heat developable photosensitive layers and said non-photosensitive layers on the base material can be carried out using the same method that is adopted in coating and preparing the conventional silver halide photosensitive materials.

For the heat developable color photosensitive material of this invention, after image exposure, development is carried out at a temperature in the range of 80°C ~ 200°C, or preferably in the range of 100°C ~ 170°C, for a time in the range of 1-180 sec, or preferably in /12 the range of 1.5-120 sec. Transfer of the diffusive dye to the image receiving layer may be carried out by bringing the image receiving surface of the image receiving material in close contact with the photosensitive surface of the photosensitive material during heat development so that transfer takes place at the same time as heat development, or by bringing the image receiving material in close contact with the photosensitive surface after heat development, or by feeding water, followed by bringing it in close contact and heating as needed. Also, it may be carried out by pre-heating at a temperature in the range of 70°C ~ 180°C before exposure. Also, as described in Japanese Kokai Patent Application Nos. Sho 60[1985]-143338 and Sho

61[1986]-162041, in order to improve adherence between them, one may preheat the photosensitive material and the image receiving material to a temperature in the range of 80°C ~ 250°C immediately before heat development transfer.

For the heat developable color photosensitive material of this invention, various heating means may be used.

Any of the heating methods that are adopted for the conventional heat developable photosensitive materials may be adopted for heating. For example, heating may be carried out by bringing it in contact with a heated block or plate, or by bringing it in contact with a heating roller or heating drum, or by feeding it through a high-temperature atmosphere, or by means of rf heating, or by setting an electroconductive layer containing carbon black or other electroconductive substance on the inner surface of the photosensitive material of this invention or on the surface of the image receiving material for heat transfer, so as to make use of the joule heat generated by feeding electricity through it. There is no special limitation on the heating pattern. The heating methods that may be adopted include the method in which preheating is performed followed by re-heating or another method for heating at a high temperature for a short time or at a low temperature for a long time, or the method in which the temperature is continuously raised or continuously lowered, or the temperature is changed repeatedly, or discontinuous heating. A simple pattern is especially preferred. Also, one may perform exposure and heating at the same time.

When the heat developable color photosensitive material of this invention is of a transfer type, as aforementioned, an image receiving material is used. In this case, the image receiving layer used in the image receiving material should have a function to receive the dyes in the heat developable photosensitive layers released or formed in the heat development. For example, as described in US Patent No. 3,709,890, the polymer containing tertiary amine or quaternary ammonium salt may be used preferably. As a negative type diffusion transfer image receiving layer, one may mix a polymer containing ammonium salt, tertiary amine, or the like with gelatin, polyvinyl alcohol, etc. and coat on a base material. As another useful dye receiving substance, one may make use of the heat-resistant organic polymeric substance having a glass transition point in the range of 40°C ~ 250°C described in Japanese Kokai Patent Application No. Sho 57[1982]-207250.

Said polymer may be carried as an image receiving layer on a base material, or it may be used as a base material itself.

As the polymers, the synthetic polymers with glass transition point of 40°C or higher described in the following reference may be used: J. Brandrup, E. H. Immergut (ed.): "Polymer Handbook", 2nd ed., published by John Wiley & Sons. Usually, the molecular weight of the aforementioned polymer substance should be in the range of 2000-200000. The polymer

substances may be used either alone or as a mixture of several types. Also, one may make use of a copolymer of two or more types of [monomers].

In particular, preferable image receiving layers include the layer made of polyvinyl chloride described in Japanese Kokai Patent Application No. Sho 59[1984]-223425 and the layer made of polycarbonate and plasticizer described in Japanese Kokai Patent Application No. Sho 60[1985]-19138.

One may also make use of said polymer as both a base material and an image receiving layer (image receiving material). In this case, the base material may be made of a single layer or plural layers.

Types of base materials for the image receiving material include transparent base materials, opaque base materials, etc. Any of them may be used. Examples of the base materials that may be used include films of polyethylene terephthalate, polycarbonate, polystyrene, polyvinyl chloride, polyethylene, polypropylene, etc., base materials prepared by containing titanium oxide, barium sulfate, calcium carbonate, talc, or other pigments in said base materials, baryta paper, resin-coated paper prepared by laminating a thermoplastic resin containing a pigment on a paper sheet, cloths, glasses, aluminum and other types of metals, base materials /13 prepared by coating and curing an electron beam curing resin composition on said base materials, as well as base materials prepared by forming a coating layer containing pigment on said base materials, etc. In addition, the cast coated paper and other coated paper sheets described in Japanese Kokai Patent Application No. Sho 62[1987]-283333 may also be used as the base material.

Also, for the base material prepared by coating and curing an electron beam curing resin composition containing a pigment on a paper sheet, or the base material has a pigment coating layer on a paper sheet and is prepared by coating and curing an electron beam curing resin composition on the pigment coating layer, as such base material can be used as an image receiving layer, it can be used as an image receiving material as is.

As described in RD (Research Disclosure) No. 15108, Japanese Kokai Patent Application Nos. Sho 57[1982]-198458, Sho 57[1982]-207250, and Sho 61[1986]-80148, the so-called mono-sheet type heat developable photosensitive material having both the photosensitive layer and the image receiving layer formed on the same base material may be used as the heat developable color photosensitive material of this invention.

It is preferred that a protective layer be formed on the heat developable color photosensitive material of this invention.

Various additives commonly used in the field of photography may be contained in the protective layer. Examples of the additives include various matting agents, colloidal silica, sliding agents, organic fluoro compounds (in particular, fluorine-based surfactants), static

inhibitors, UV absorbents, high-boiling point organic solvents, oxidation inhibitors, hydroquinone derivatives, polymer latex, surfactants (including polymeric surfactants), film hardeners (including polymeric film hardeners), organic silver salt particles, non-photosensitive silver halide grains, fog inhibitors, development accelerating agents, etc.

These additives are described in RD (Research Disclosure) Vol. 170, No. 17029, June 1978, and Japanese Kokai Patent Application No. Sho 62[1987]-135825.

Application examples

In the following, this invention will be explained in detail with reference to application examples. However, this invention is not limited to these application examples.

Application Example 1

In this application example, a silver iodobromide emulsion, a dispersion of an organic silver salt and thermal solvent, a dispersion of dye-supplying substance, and a dispersion of reducing agent were prepared as listed below. They were then used to prepare a heat developable color photosensitive material. Also, an image receiving material was prepared as described below.

[1] Preparation of silver iodobromide emulsion

At 50°C and using a blender/agitator described in Japanese Kokai Patent Application Nos. Sho 57[1982]-82523 and Sho 57[1982]-92524, 500 mL of liquid (B) as an aqueous solution containing 11.6 g of potassium iodide and 111 g of potassium bromide and 500 mL of liquid (C) as an aqueous solution containing 1 mol of silver nitrate and ammonia were added simultaneously in liquid (A) prepared by dissolving 20 g of osein [sic; casein] gelatin in 1000 mL of distilled water and ammonia, while pAg was kept constant during the addition process.

The shape and size of the of the prepared emulsion grains were adjusted by controlling pH, pAg, and the speed for adding liquid (B) and liquid (C). In this way, a core emulsion with content of silver iodide of 7 mol% and containing regular octahedron grains with average grain size of 0.25 µm was prepared.

Then, using the same method as aforementioned, by covering a shell of silver halide with content of silver iodide of 1 mol%, a core/shell type silver halide emulsion containing regular octahedron grains with average grain size of 0.3 µm (with single dispersion rate of 9%) was prepared. The emulsion prepared in this way was subjected to water washing and desalting.

[2] Preparation of photosensitive silver halide dispersion

The following listed components were added into 700 mL of the silver iodobromide emulsion prepared in as above for chemical sensitization and spectral sensitization, forming various photosensitive silver halide emulsions of red sensitivity, green sensitivity, and blue sensitivity.

(a) Preparation of red-sensitive silver iodobromide emulsion

Said silver iodobromide emulsion:	700 mL
4-hydroxy-6-methyl-1,3,3a,7-tetrazaindene gelatin:	0.4 g
Gelatin:	32 g
Sodium thiosulfate:	10 mg
1 wt% methanol solution of following listed sensitizing dye (a):	80 mL
Distilled water:	1200 mL

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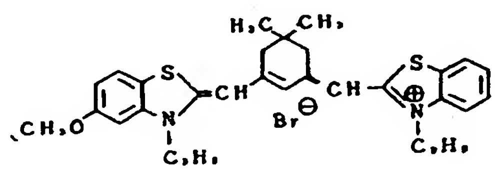
Sensitizing dye (a)



(b) Preparation of green-sensitive silver iodobromide emulsion

Said silver iodobromide emulsion: 700 mL

4-hydroxy-6-methyl-1,3,3a,7-tetrazaindene gelatin: 0.4 g

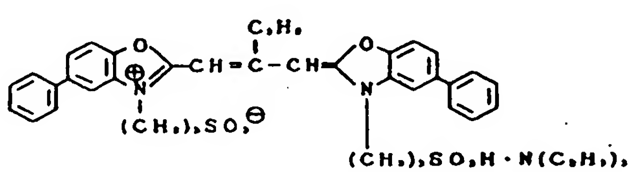
Gelatin: 32 g

Sodium thiosulfate: 10 mg

1 wt% methanol solution of following listed sensitizing dye (b): 80 mL

Distilled water: 1200 mL

Sensitizing dye (b)



(c) Preparation of blue-sensitive silver iodobromide emulsion

Said silver iodobromide emulsion: 700 mL

4-hydroxy-6-methyl-1,3,3a,7-tetrazaindene gelatin: 0.4 g

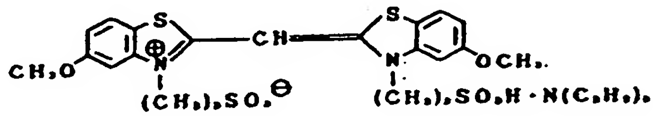
Gelatin: 32 g

Sodium thiosulfate: 10 mg

1 wt% methanol solution of following listed sensitizing dye (c): 80 mL

Distilled water: 1200 mL

Sensitizing dye (c)



[3] Dispersion of organic silver salt and thermal solvent

On the base of the following listed recipe, a dispersion of organic silver salt and thermal solvent was prepared.

Recipe

5-methyl benzotriazole silver: 60.5 g

p-tolylamide: 346 g

Polyvinyl pyrrolidone (10%): 446 mL

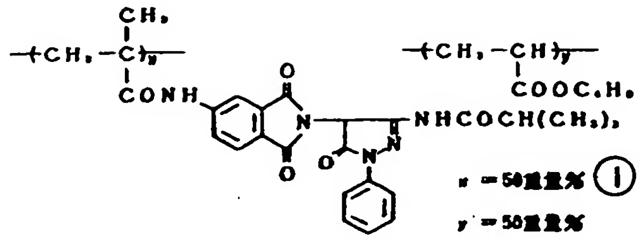
Water added to 2000 g

After dispersion using an alumina ball mill, 10% aqueous solution of citric acid was used to adjust pH to 5.5, and a dispersion of organic silver salt and thermal solvent was prepared.

[4]-1 Preparation of dye-supplying substance dispersion 1

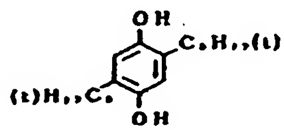
35.5 g of following listed polymeric dye-supplying substance (1) and 5.0 g of the following hydroquinone compound were dissolved in 200 mL of ethyl acetate. Then, 124 mL of 5 wt% of Alkanol XC (product of DuPont Co.) and 720 mL of gelatin aqueous solution containing 36.5 g of phenyl carbamoylated gelatin (type 17819 PC, product of Rusuro [transliteration] Co.) were added, and the mixture was dispersed using an ultrasonic homogenizer. After ethyl acetate, pH was adjusted to 5.5, and 795 mL of dye-supplying substance dispersion 1 were obtained.

Polymer dye-supplying substance (1)



Key: 1 Wt%

Hydroquinone compound



[4]-(2) Dye-supplying substance dispersion 2

Dye-supplying substance dispersion 2 was prepared in the same way as for dye-supplying substance dispersion 1, except that the dye-supplying substance was changed to following listed polymer dye-supplying substance (2) and IR dye-supplying substance (control compound 1).

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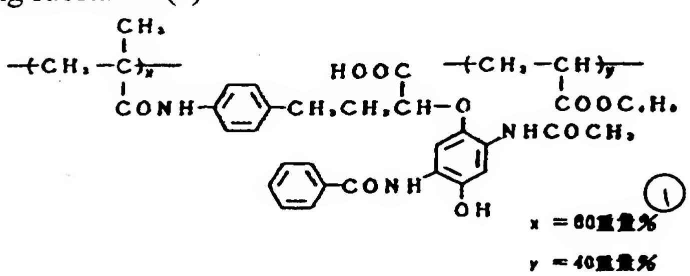
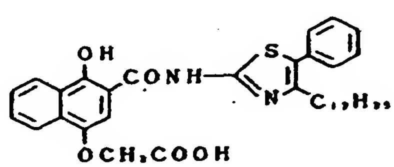
Polymer dye-supplying substance (2)



Key: 1 Wt%

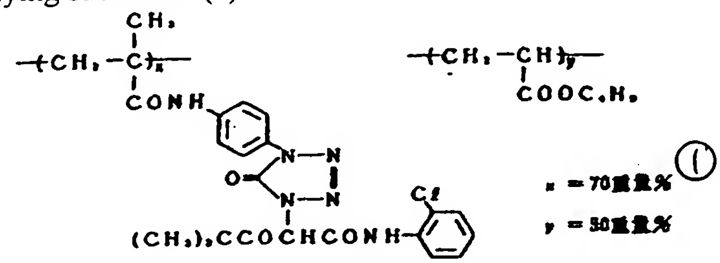
IR dye-supplying substance (control compound 1)



[4]-(3) Dye-supplying substance dispersion 3

Dye-supplying substance dispersion 3 was prepared in the same way as for dye-supplying substance dispersion 1, except that the dye-supplying substance was changed to following listed polymer dye-supplying substance (3).

Polymer dye-supplying substance (3)

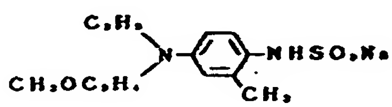


Key: 1 Wt%

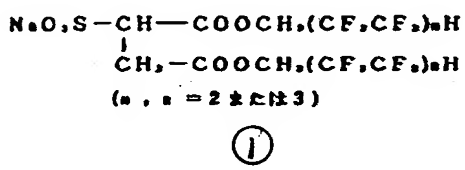
[5] Preparation of reducing agent solution

23.3 g of the following listed reducing agent, 14.6 g of poly(N-vinyl pyrrolidone), and 0.50 g of following listed fluorine based surfactant were dissolved in water. pH was adjusted to 5.5, forming 250 mL of a reducing agent solution.

Reducing agent:



Surfactant:



Key: 1 Or

[6] Preparation of heat developable color photosensitive material

Using the dispersion of organic silver salt and thermal solvent, silver halide emulsion, dye-supplying substance dispersion, and reducing agent solution prepared in the above, multi-layer heat developable color photosensitive material (1) listed in Table I was prepared.

Also, photosensitive materials (2)-(5) were prepared (with types and amounts of the added compounds listed in Table II) were prepared in the same way as said photosensitive material (1), except that the IR coupler represented by formula (1) was added instead of the IR

dye-supplying substance (control compound 1) in the 6th layer of said photosensitive material (1).

For the IR dyes formed from the IR coupler represented by formula (1) used in this application example, the absorption maximum values (measured according to the reflective density in the image receiving material) are as follows.

IR dye formed from IR-1: Absorption maximum at 810 nm
IR dye formed from IR-9: Absorption maximum at 816 nm
IR dye formed from IR-16: Absorption maximum at 802 nm
IR dye formed from IR-17: Absorption maximum at 810 nm

Table 1 /16

1	第7層	保護層 8	ゼラチン 0.71g, フェニルカルバモイル化ゼラチン 0.36g, ポリビニルピロリドン (K−30) 0.53g, 還元剤 0.48g, トリクレジルフォスフェート 0.2g	16
2	第6層	青感層 9	5−メチルベンゾトリアゾール銀 2.5g, 還元剤 1.2g, トリクレジルフォスフェート 0.344g, 高分子色素供与物質 (2) 1.13g, 青感性ハロゲン化銀乳剤 0.76gAg, ゼラチン 1.22g, フェニルカルバモイル化ゼラチン 0.61g, ポリビニルピロリドン (K−30) 0.92g, 熱溶剤 (p−トルアミド) 4.89g	17
3	第5層	第2中間層 10	ゼラチン 1.77g, 還元剤 0.53g, トリクレジルフォスフェート 0.22g, イエローフィルター色素 (F−1) 0.1g	18
4	第4層	緑感層 11	5−メチルベンゾトリアゾール銀 0.8g, 還元剤 0.675g, トリクレジルフォスフェート 0.2g, 高分子色素供与物質 (1) 0.9g, 緑感性ハロゲン化銀乳剤 0.457g Ag, ゼラチン 1.0g, フェニルカルバモイル化ゼラチン 0.5g, ポリビニルピロリドン (K−30) 0.75g, 熱溶剤 (p−トルアミド) 4g, ブタントリオール 0.25g	19
5	第3層	第1中間層 12	ゼラチン 0.50g, 還元剤 0.49g, トリクレジルフォスフェート 0.2g	20
6	第2層	赤感層 13	5−メチルベンゾトリアゾール銀 1.6g, 還元剤 0.8g, トリクレジルフォスフェート 0.33g, 高分子色素供与物質 (3) 1.06g, 赤感性ハロゲン化銀乳剤 0.68gAg, ゼラチン 1.18g, フェニルカルバモイル化ゼラチン 0.59g, ポリビニルピロリドン (K−30) 0.89g, 熱溶剤 (p−トルアミド) 5.2g	21
7	第1層	ゼラチン層 14	ゼラチン 2.5g	22
15	支持体		ラテックス下塗りを施した厚さ 180μm の透明ポリエチレンテレフタレートフィルム	23

24
各添加量は1㎡当たりの付量を表す。
(但し、ハロゲン化銀は銀に換算した値である。各層にはこれらの他に少量の界面活性剤、硬膜剤を含有する。)
第5層のフィルター色素 (F−1) の構造は次頁に示す。

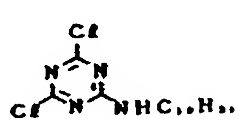
Key:
1 7th layer
2 6th layer
3 5th layer
4 4th layer
5 3rd layer
6 2nd layer
7 1st layer
8 Protective layer
9 Blue photosensitive layer
10 Second intermediate layer
11 Green photosensitive layer
12 First intermediate layer

13 Red photosensitive layer
14 Gelatin layer
15 Base material
16 0.71 g of gelatin, 0.36 g of phenyl carbamoylated gelatin, 0.53 g of polyvinyl pyrrolidone (K-30), 0.48 g of reducing agent, 0.2 g of tricresyl phosphate
17 2.5 g of 5-methyl benzotriazole silver, 1.2 g of reducing agent, 0.344 g of tricresyl phosphate, 1.13 g of polymer dye-supplying substance (2), 0.76 g Ag of blue photosensitive silver halide emulsion, 1.22 g of gelatin, 0.61 g of phenyl carbamoylated gelatin, 0.92 g of polyvinyl pyrrolidone (K-30), 4.89 g of thermal solvent (p-triamide)
18 1.77 g of gelatin, 0.53 g of reducing agent, 0.22 g of tricresyl phosphate, 0.7 g of yellow filter dye (F-1)
19 0.8 g of 5-methyl benzotriazole silver, 0.675 g of reducing agent, 0.2 g of tricrecyl phosphate, 0.9 g of polymer dye-supplying substance (7), 0.457 g Ag of green photosensitive silver halide emulsion, 1.0 g of gelatin, 0.5 g of phenyl carbamoylated gelatin, 0.75 g of polyvinyl pyrrolidone (K-30), 4 g of thermal solvent (p-triamide), 0.25 g of butane triol
20 0.50 g of gelatin, 0.49 g of reducing agent, 0.2 g of tricresyl phosphate
21 1.6 g of 5-methyl benzotriazole silver, 0.8 g of reducing agent, 0.33 g of tricrecyl phosphate, 1.06 g of polymer dye-supplying substance (3), 0.68 g Ag of red photosensitive silver halide emulsion, 1.18 g of gelatin, 0.59 g of phenyl carbamoylated gelatin, 0.89 g of polyvinyl pyrrolidone (K-30), 5.2 g of thermal solvent (p-triamide)
22 2.5 g of gelatin
23 180-μm-thick transparent polyethylene terephthalate film applied with latex pimer coating
26 Each amount refers to that for 1 m^2 (For silver halide, the amount is that of silver equivalent. Each layer may also contain small amounts of surfactant and film hardener). For 5th layer, the structure of the filter dye (F-1) is shown below.

[†7] Preparation of image receiving material

Following listed compounds (A) and (B) were dissolved in tetrahydrofuran solution of polyvinyl chloride (n=1,100, product of Wako Pure Chemical Co., Ltd.). The solution was coated and dried on a photographic baryta paper such that the amount of polyvinyl chloride was 15.0 g/m^2. In this way, an image receiving material was formed.

Compound (A)



1

Key: 1 Amount applied:

Compound (B)

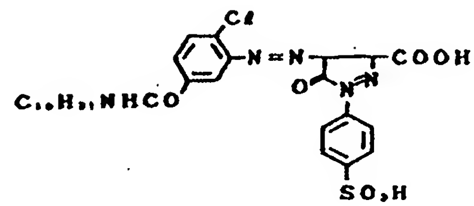
$HOCH_2CH_2SCH_2CH_2SCH_2CH_2OH$

付量 600mg/m^2

1

Key: 1 Amount applied:

F-1



For said heat developable color photosensitive materials (1)-(5), exposure was performed through a step wedge with 800 CMS blue light, green light, red light and white light. Each heat developable color photosensitive material was then overlapped with an image receiving material, and the laminate was set in a heat developing device (DEVELOPER MODULE 277, product of 3M Co.) for heat development at 150°C for 70 sec. Photosensitive materials (1)-(5) and image receiving materials were separated quickly, and for the obtained yellow (Y), magenta (M), and cyan (C) images of the image receiving materials, the reflective density was measured, and the reflective density with respect to IR light (850 nm) was measured by means of a densitometer (PDA-65, product of Konica Corp.). The obtained maximum density (Dmax) and minimum density (Dmin) (fog) are listed in Table 2.

The IR image was observed in the blue light and white light exposure portions. In Table 2, for the maximum density portion in the image (black) of the white exposure portion, reflective density measured with IR light is listed. /17

Table 2

1 感光材料	2 使用した一般式(1)の赤外カプラー、または比較化合物	3 添加量	Y		M		C		6 赤外光
			4 最高濃度 Dmax	5 最小濃度 Dmin	4 最高濃度 Dmax	5 最小濃度 Dmin	4 最高濃度 Dmax	5 最小濃度 Dmin	4 最高濃度 Dmax
1 (比較)	比較化合物－1	0.5 g	1.64	0.11	1.95	0.14	1.82	0.10	0.63
2 (本発明)	IR－1	0.35g	1.63	0.12	1.93	0.13	1.80	0.08	1.05
3 (本発明)	IR－9	0.4 g	1.66	0.10	1.91	0.12	1.85	0.09	1.10
4 (本発明)	IR－16	0.5 g	1.61	0.11	1.94	0.12	1.83	0.11	1.01
5 (本発明)	IR－17	0.5 g	1.65	0.12	1.82	0.14	1.81	0.10	1.08

Key:
1 Photosensitive material
2 IR coupler represented by formula (1) or control compound used
3 Amount added
4 Maximum density
5 Minimum density

6 IR light
7 Comparative Example
8 This invention
9 Control Compound 1

As can be seen from the results listed in Table 2, for the heat developable color photosensitive material of this invention, the density obtained with IR light is higher than that for the sample using the control compound in equal molar amount.

In this application example, it is possible to record color images as well as text information, signal information, etc. at a high image quality. Also, it allows simple and quick treatment. In this way, the basic requirement is met for the heat developable color photosensitive material.

Also, the heat developable color photosensitive material of this invention allows recording of text information and signal information that can be read with light at wavelength longer than 750 nm while color image is formed. Also, compared with the sample prepared by using the conventional IR coupler in equal molar amount, the sample prepared by using the IR coupler represented by formula (1) has a higher density obtained using IR light. This is an advantage. In addition, it also has excellent thermal stability and transfer property.

Effect of the invention

As explained in the above, this invention provides a type of heat developable color photosensitive material that has various advantages: It allows easy reading of the recorded information with light at wavelength longer than 750 nm, it has a low fog level, and it has a high coloring level.